Weqas
GLOBAL PROVIDER OF QUALITY IN DIAGNOSTIC MEDICINE

UKAS PROFICIENCY TESTING 4301
UKAS CALIBRATION 4301

Tel: +44 (0) 2920 314750
E-mail: contact@weqas.com
Web: www.weqas.com

Weqas
Unit 6, Parc Tŷ Glas
Llanishen, Cardiff, UK
CF14 5DU

Use of EQA to help resolve laboratory performance issues

M.A. Thomas, S. Jones, G. Davies
Weqas, Cardiff and Vale University Health Board, Cardiff, UK

Introduction

EQA in medical laboratories has evolved over the past 50 years to provide more sophisticated systems compared with the simple analytical performance evaluation of earlier years. Pre- and post- analytical elements are provided as well as data interpretation, problem solving and education.

Weqas programmes are underpinned by commutable, metrological, traceable samples, informative reports, educational workshops and problem-solving support. These tools are pivotal to help resolve laboratory performance issues and improve quality.

Education and problem solving support Examples include:

- *Dedicated helplines* providing performance interpretation and troubleshooting advice.
- *Support Literature* to help participants identify and correct analytical errors, Interpretation guides for reports, troubleshooting algorithms and e-learning.
- *Repeat Samples* for investigation of performance issues.
- *Workshops* with Case Studies for interpretation and problem solving.

Identifying types of errors in the Laboratory Fig 1a- 1h

Inaccuracy: identified using the linear regression equation, $y = mx + c$, where y is the lab result, x the target value, m the slope of the line, and c the y-intercept. Deviation from m = 1.0 suggests systematic proportional error, whilst c gives a measure of the systematic constant error.

Fig 1a. Types of Errors in Accuracy

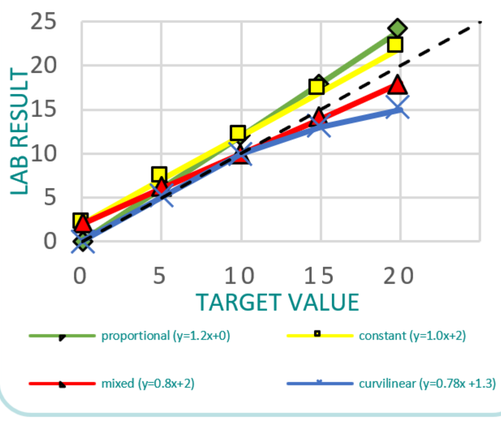


Fig 1b. No Error

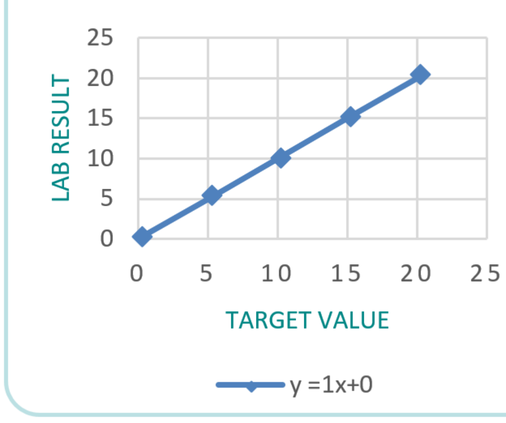


Fig 1c. Systematic Proportional (Positive Bias)

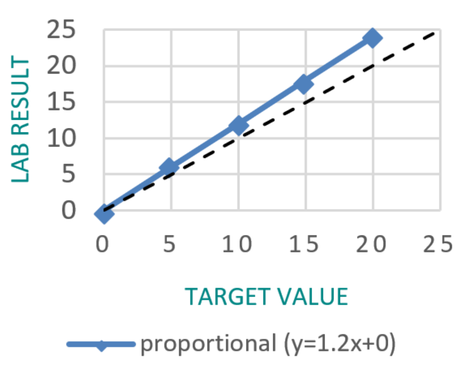


Fig 1d. Systematic Proportional (Negative Bias)

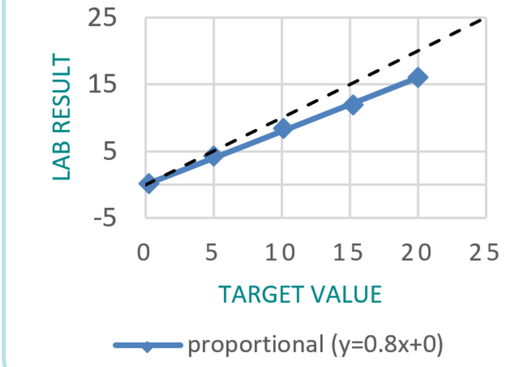


Fig 1e. Constant (Positive Bias)

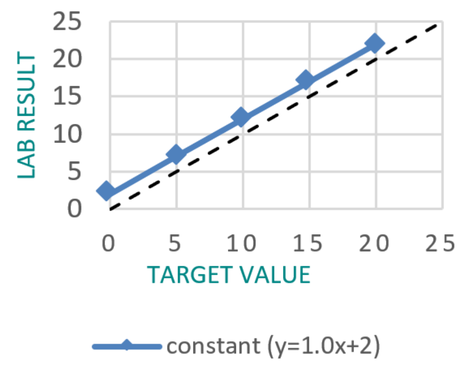


Fig 1f. Constant (Negative Bias)

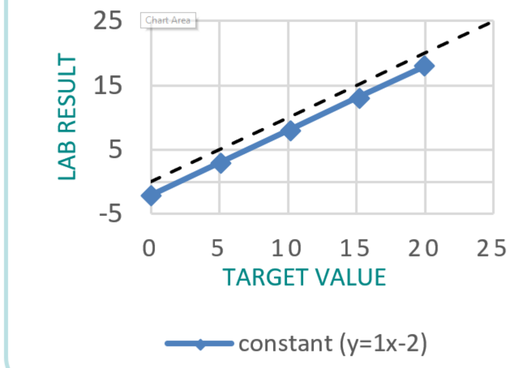


Fig 1g. Mixed

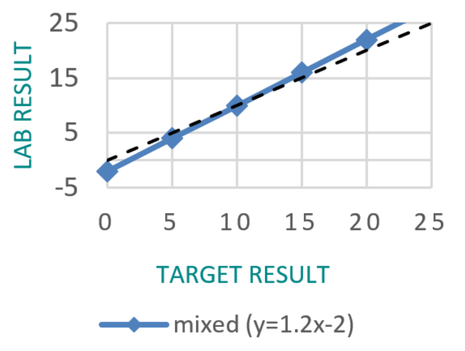
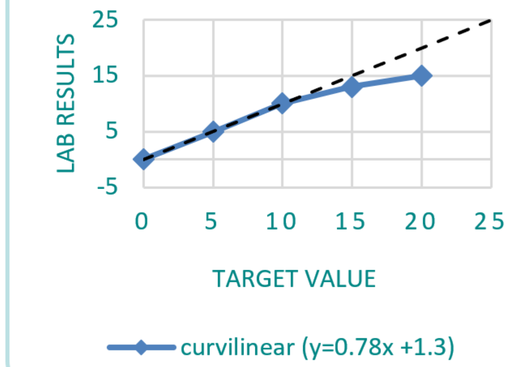
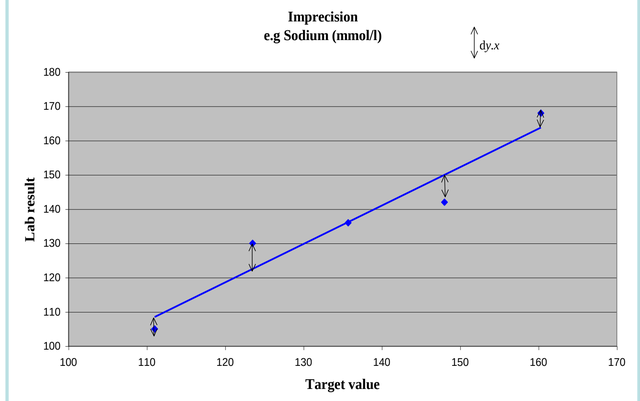


Fig 1h. Curvilinear



Imprecision: identified using metrics that measure dispersion of the data about the best fit line (Coefficient of Linear Correlation, (r) and the Standard Deviation of the Residuals, (*Sy.x*).



$Sy.x = \sqrt{\Sigma dy.x^2/d.f}$

$dy.x = y - \tilde{y}$

where y = observed value, *d.f* = degrees of freedom and $\tilde{y}$ is the value on the line of best fit.

$r = \Sigma(\bar{x}-x)(y-\bar{y}) / \sqrt{\Sigma(\bar{x}-x)^2\Sigma(y-\bar{y})^2}$

Error detection algorithm

The algorithm leads the participant through a series of questions using their EQA reports to identify any errors. Start by asking the question - **Is it Imprecision?** Check for causes in the following order:

Exclude apparent imprecision due to curvilinear data.
Exclude clerical errors (blunder error).
Check for causes of imprecision, e.g. inexperienced operators (analysts), faulty equipment, inappropriate methods.

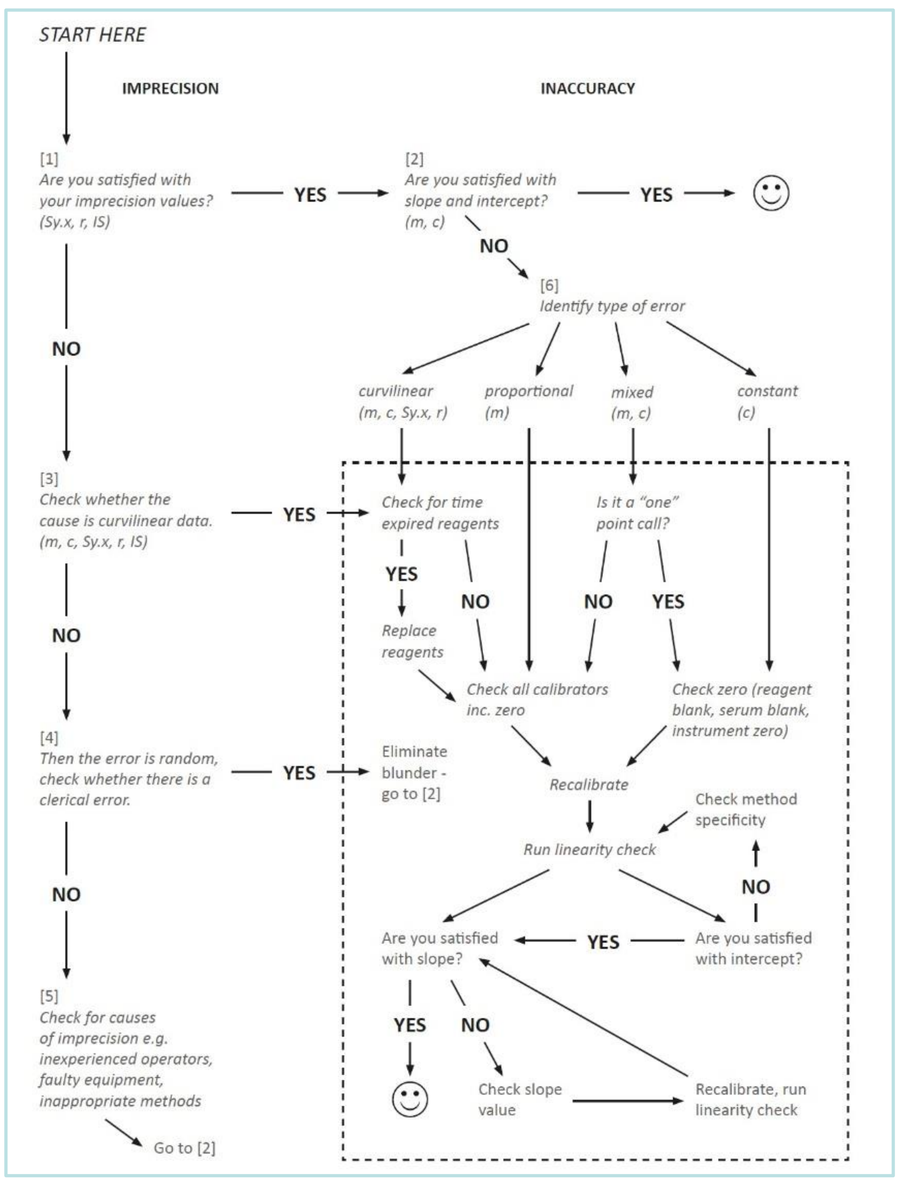
Once you are happy with your analytical precision you can then look for causes of inaccuracy. Refer to Figures 1a - h to identify the error.

Systematic proportional: Identified from the slope *m*, usually due to calibration (Figs 1c & 1d).

Systematic constant: Identified from intercept, *c*, usually due to blanking error from reagent, serum or instrument zero (Figs 1e & 1f).

Mixed systematic: Identified from combined errors of both *m* and *c.* On one point calibration with a cross-over at or near a calibration point (pivoting about calibration point), check zero calibration point, i.e. reagent blank, serum blank, instrument zero and then follow guide as for proportional systematic error. For a two point multi calibration with cross-over at or near one point, check other calibrators and/or zero point (Fig 1g)

Curvilinear data: Identified from *m, c &* a poor *r value,* usually due to reagent deterioration or deterioration in calibrators if multiple calibration curve used (Fig 1h)



Conclusion

The key objective of EQA is in identifying laboratory performance issues and to provide the necessary tools to help resolve those issues. EQA should not be seen as a 'tick box exercise' or a pass/fail exercise but should be used to support laboratories in continuously improving services for the benefit of patients. Feedback from participants using Weqas problem solving tools has supported their effectiveness in improving the laboratory performance. Case studies of EQA reports including interpretive comments are available to download from our website: http://www.weqas.com/resourcelibrary